

**MANAGEMENT OF THE UNDERWATER AND COASTAL
ARCHAEOLOGICAL HERITAGE IN ISRAEL'S SEAS (II): THE
ENDANGERED COASTAL SETTLEMENTS**

**GESTIÓN DEL PATRIMONIO ARQUEOLÓGICO SUBACUÁTICO Y
COSTERO EN LOS MARES DE ISRAEL (II): LOS YACIMIENTOS
LITORALES EN RIESGO.**

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ABSTRACT

The two articles titled Management of the underwater and coastal archaeological heritage in Israel's seas – parts A and B aim at presenting the diversity, nature and significance of an important cultural resource at risk, namely the underwater and coastal archaeological sites of Israel. Part I introduces the typology of the sites on the Mediterranean coast and the inland seas (The Sea of Galilee and the Dead Sea). Part II presents the main endangered sites along the Mediterranean coast of Israel, their archaeological and historical significance, the risks they are facing and the measures that have to be taken in order to ensure their long term preservation.

KEY WORDS: Near-Eastern Archaeology, Coastal sites, Risk assessment, Submerged prehistory.

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RESUMEN

Los dos artículos presentados con el título “Gestión del patrimonio arqueológico subacuático y costero en los mares de Israel” apuntan a la diversidad, naturaleza y trascendencia de un importante recurso cultural en riesgo, concretamente los yacimientos arqueológicos submarinos y costeros de Israel. En la primera parte introducíamos la tipología de los asentamientos sobre la costa mediterránea y los mares interiores (el Mar de Galilea y el Mar Muerto). Esta segunda parte presenta los yacimientos más amenazados a lo largo de las costas israelíes del Mediterráneo, su histórica y arqueológica importancia, los riesgos a los que se enfrentan y las medidas que deben ser tomadas con objeto de asegurar su preservación a largo plazo.

PALABRAS CLAVES: Arqueología próximo-oriental, yacimientos costeros, evaluación de riesgos, Prehistoria sumergida.

The main coastal settlements at risk on the Mediterranean Coast of Israel

Comprehensive risk assessment surveys and detailed conservation plans were conducted for 7 major sites on the ca 200 km long Mediterranean coast of Israel, including the three harbor cities: Akko, Atlit and Caesarea, and the sites of Apollonia, Yavne-Yam, Ashkelon North, and Tell Ashkelon. Partial risk assessment surveys were performed for other coastal sites: Akhziv, Tell Tanninim, Tell Dor, Ashdod-Yam, and the submerged prehistoric settlements Atlit-Yam and Neve-Yam (Fig. 1, Tables 1, 2).

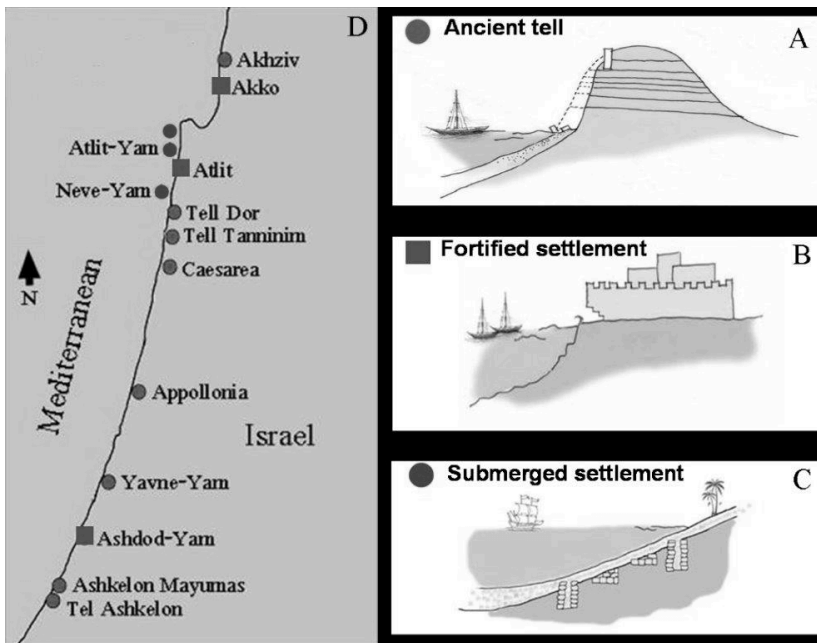


Fig. 1- Endangered ancient settlements on the Mediterranean Coast of Israel – types and distribution.

In Fig. 1 the sites are arranged according to three main categories: **1:** A coastal settlement (an ancient Tell) eroded by the

sea, resulting in a massive destruction and the collapse of entire parts of the seafront (Fig. 1A); **2:** An ancient coastal city with a seawall built on a bedrock foundation, with the city walls damaged by wave action (Fig. 1B); **3:** A prehistoric site inundated by the sea (Fig. 1C). The main coastal settlements at risk are presented below from north to south, with the three major port cities: Akko, Atlit and Caesarea, first.

Akko (Acre)

Declared a World Heritage Site, Akko is a traditional Mediterranean town thriving around an ancient fortified city, which has functioned continuously for thousands of years. The early strata, dated to the Bronze Age, are located at Tell Akko, some 500 m east of the present shoreline. During the Hellenistic period, the coastal area and the peninsula west of Tell Akko was settled and the harbor was built (type C1)³. Under Crusader rule, Akko reached the peak of its importance in the 13th century C.E., being the capital and major port of the country. The Ottoman city was built on top of the ancient ruins and the walls were rebuilt. Having served for over two millennia, the port was renewed during the 20th century and is used presently for local fishing boats and yachts.

³ E. GALILI, S. ARENSON, "Management of the underwater and coastal archaeological heritage in Israel's seas (I)", *RIPARIA* 0, 2014, 151-177; E. GALILI, B. ROSEN, D. ZVIELY, N. SILBERSTEIN, J. FINKIELSZTEIN, "The Evolution of the Akko harbor and its trade links revealed by recent underwater and coastal archaeological research", *Journal of Island and coastal Archaeology* 5, 2010, 191-211; A. RABAN, "The ancient harbours of Israel in Biblical times", A. RABAN (ed.), *Harbour Archaeology: Proceedings of the First International Workshop on Ancient Mediterranean Harbours, Caesarea Maritima*, 24-28 June 1983, *BAR International Series*, S257, Oxford 1985, 11-44; E. GALILI, A. RABAN, J. SHARVIT, "Forty years of Marine Archaeology in Israel", *Tropis* 7, 1999 (2002), 927-961; E. GALILI, B. ROSEN, "Preserving the maritime cultural heritage of the Mediterranean, a cradle of cultures, religions and civilizations - the holy land perspective", *Journal of coastal conservation and Coastal Management*, special issue 14, 2010, 303-315; E. GALILI, J. SHARVIT, U. DHARI, N. BAHAT-ZILBERSTEIN, G. -FINKIELSZTEIN, E.J. STERN, R. COOL, Y. KAHANOV, B. ROSEN, "Akko Port, underwater surveys", *Hadashot Arkheologiyot* 114, 2002, 13-16, 12*-15*, (Hebrew/English*).

Principal risks: The lower parts of the city walls, founded on *kurkar* bedrock, are damaged by marine weathering. In the southeastern sections of the city, the walls are founded on unconsolidated sediment, thus sections of the walls in this area are at risk of collapse⁴.

Measures implemented: A comprehensive risk assessment survey of the city walls was conducted and a detailed conservation plan was prepared. Underwater rescue surveys and excavations were conducted while the harbor was deepened. Conservation and protection works on the sea wall of the Pisan quarter were completed during 2007. Maintenance and conservation works were undertaken on the western and southern sea walls and their foundations were strengthened (Fig. 2).

Measures required: Conservation, protection and reconstruction works: It is essential to continue the emergency treatment of the endangered city wall sections, according to the risk assessment survey and the detailed program. Once stabilized, continuous monitoring of the sea walls condition (locating new risks) is to be done. An ongoing multi-year maintenance program should be implemented along the sea front, including: conservation and reconstruction treatment, filling in voids, adding stones and maintaining the protective agents.

Archaeological measures: Underwater surveys during harbor works, maintenance and dredging, should be carried out.

⁴ N. ANGART, E. GALILI, "The National Nature and Parks Authority", *Policy document for the coastal and marine –Mediterranean national marine reserves*, Jerusalem 2010, 1-31 (Hebrew).

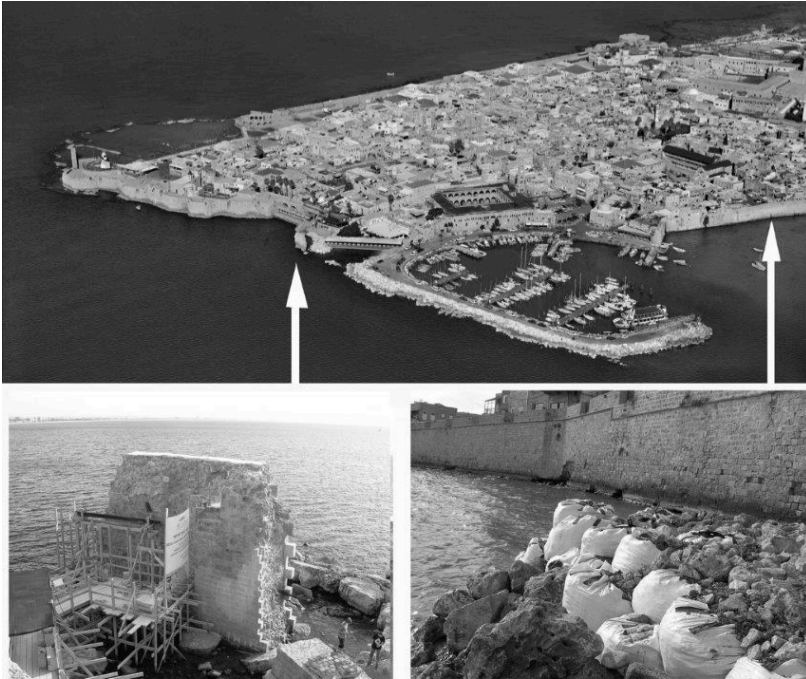


Fig. 2- The Akko city walls under conservation works by the Israel Antiquities Authority (Aerial photo: Hetz Hazafon, city walls E.G.).

Atlit (*château pèlerins*)

The site is a coastal settlement and a National Park with well-preserved Phoenician harbor (type C1) and Crusader fortress ruins (Fig. 3)⁵. The fortress, situated on a peninsula, is built on a kurkar rock and has a complex system of fortifications, including walls, towers and a moat. The settlement was founded in the Middle Bronze Age and the harbor remains date to the ninth century BC. East of the fortress lies the Phoenician and walled

⁵ A. RABAN, “The ancient harbours...”; H. ARAD, “Harbors in Phoenicia, Israel and Philistia in the 9th–7th Centuries BCE: Archaeological Finds and Historical Interpretation”, *Rekanati Institute for Maritime Studies (RIMS) news* 35, 1999, 33- 37; E. GALILI, “Ancient harbors and anchorages along the Israeli coast after five decades of underwater and coastal research”, *Kadmoniot* 327, 2009, 1-21, (Hebrew); N. ANGART, E. GALILI, “The National Nature...”.

Crusader city, today within the confines of a military base⁶. Northeast of the fortress lies a Crusader cemetery with hundreds of tombstones, some of which are decorated. A cement wall built several decades ago to protect the cemetery is being destroyed in several places. The fortress is subject to weathering as a result of waves, sea-spray and winds. Underwater surveys were carried out and scores of shipwreck assemblages were documented, some carrying cargoes and weapons (Fig 4).

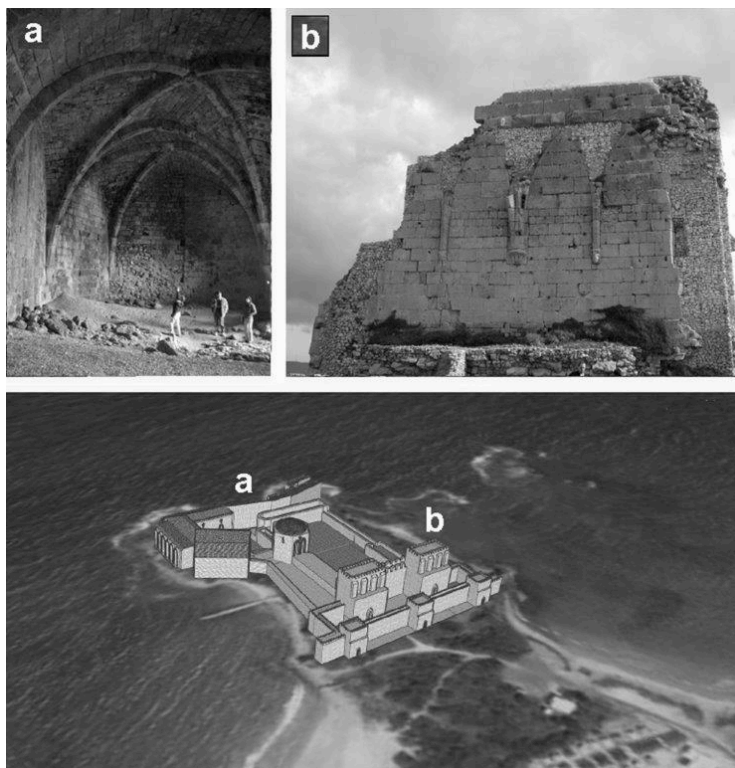


Fig. 3 - Bottom: Atlit peninsula and the reconstruction of the Crusader fortress; top a: the western hall; top b: the wall of the north-eastern tower.

⁶ C.N. JOHNS, *Guide to Atlit*, Jerusalem 1947; A. RONEN, Y. OLAMI, *Atlit Map*. Israel Archaeological survey, Jerusalem 1947.

In addition, a risk assessment survey and conservation and protection plans were prepared. The Crusader fortress requires conservation and rehabilitation works, similar to Akko above. The cement wall protecting the Crusader cemetery needs repairs. Underwater salvage excavations and surveys are needed in order to locate, document and save the ancient remains exposed on the seabed.

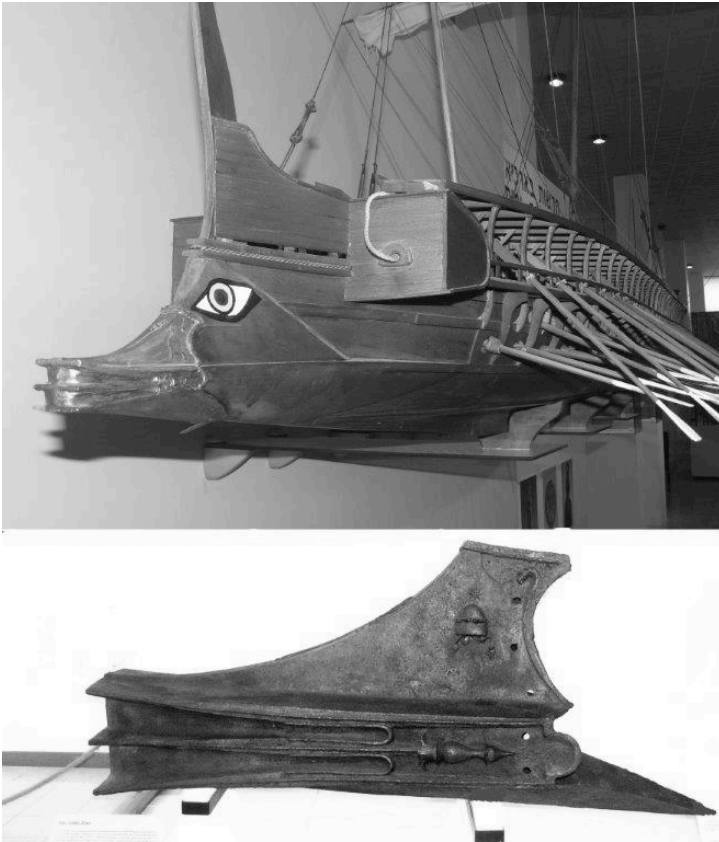


Fig. 4 - Bottom: the bronze battering Ram from Atlit North Bay; Top: reconstruction of the ship carrying the ram (E.G.)

Caesarea (Caesarea Maritima)

Caesarea is an ancient coastal city surrounded by a Crusader wall and functioning as a National Park. The city, founded during the Hellenistic period, reached its peak in Roman and Byzantine times. King Herod built here a large harbor (type C1), which became a hub of maritime trade in the Levant. The harbor subsided within a hundred years and its remains lie well preserved on the seabed. After the fall of Jerusalem, Caesarea became the capital of the country for about 600 years and several public complexes were built. It reached its maximum expansion in the Byzantine period. During the medieval period a new city wall was erected, but after the Mamluk conquest it lay in ruins⁷. Several shipwreck assemblages dating from the Late Bronze Age onwards were recovered in the anchorages located south and north of the harbor.

Principal risks: There is a significant narrowing of the coast following the construction of a power plant cooling pool south of the site. The waves are eroding the foot of the site, creating notches and causing safety problems. There is a severe destruction of the sea front of the Byzantine and the Crusader cities (Figs. 5). Parts of the Tell are collapsing, many monumental archaeological assets are destroyed and the information is lost. The north side of the Crusader sea wall and sections of the Roman aqueduct are severely damaged during storms. Remains of ships and cargo are exposed on the seabed and are at risk of destruction and treasure hunting.

⁷ A. RABAN, "The ancient harbours..."; A. RABAN, "The Harbors of Sebastos (Caesarea Maritima) in its Roman Mediterranean context", M. ARTZI, B. GOODMAN, Z. GAL (eds), *BAR International Series* 1930, Oxford 2009; E. GALILI, B. ROSEN, D. ZVIELY, A. SALAMON, "Mooring and anchoring installations in Caesarea and the destruction of the Herodian Harbor, reevaluation based on underwater excavations and surveys", S. PORAT (ed), *Treasures of Caesarea*, Caesarea 2011, 41-66 (Hebrew).



Fig. 5 - Top: the Roman high level aqueduct in Caesarea- a 500 m section of the aqueduct was eroded in the past; Bottom: the Byzantine city ruins undergoing marine erosion.

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Protective measures implemented: The risk assessment survey includes division into sections, locating and classifying reconstruction, conservation and safety problems, and specifying priorities (Fig. 6). Conservation works were done on the northern Crusader city wall and the northern Byzantine city wall. Buildings and installations on the beach exposed by storms were documented. A protective submerged breakwater, a promenade and a seawall were constructed in the south sea front. An underwater survey located, documented and salvaged finds exposed on the sea bottom.

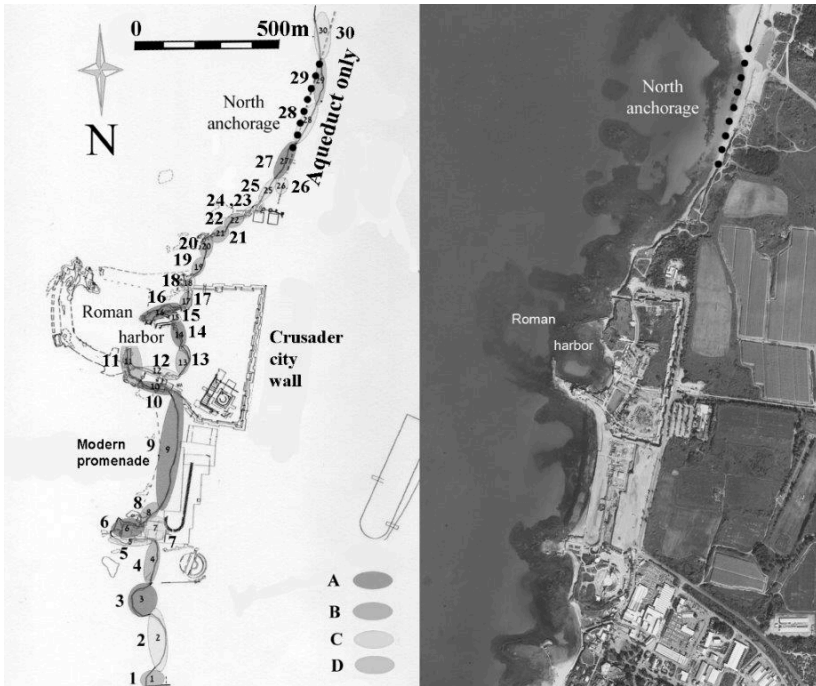


Fig. 6 - Left: risk assessment survey map of Caesarea sea front, demonstrating the coastal sections (numbers 1-30), degree of preservation and priorities of treatment in each section: A = severely threatened, B = threatened, C = partly threatened at some locations, D = stable (Leonid Tzaskin, E.G.).

Measures required: Reconstruction and conservation measures: It is of utmost importance to continue the protection of selected sections of the sea-front and to reinforce ancient building foundations. Other immediate steps needed: Correct the drainage and gradients of the shoreline; stabilize slopes by nets and vegetation; conserve buildings and installations, fill in voids, support and reinforce foundations. Maintenance and monitoring of buildings and installations should go on regularly.

Archaeological measures required: Salvage excavations in the Byzantine city and the Crusader city seafront, emergency documentation and salvage of underwater remains exposed following storms; processing, research and publication of the finds. The line of action detailed above for Caesarea applies also to the sites at Akhziv, Dor, Apollonia, Yavne-Yam, Ashkelon Mayumas and Tell Ashkelon, listed below. Underwater rescue surveys were carried out and should continue.

Tell Akhziv

Akhziv (Fig. 1) is an ancient coastal settlement and a National Park⁸. The site was inhabited almost continuously from the Middle Bronze Age until the 20th century. On the abrasion platform opposite the Tell there is a rock-cut rectilinear pool used for aquaculture and other coastal industries in antiquity. A small modern breakwater was built at the site's seafront, partially protecting the coastal Tell. Underwater surveys were carried out, risk assessment survey and preservation plans were prepared. Protection and conservation works are required along the seafront, as well as salvage excavations and underwater surveys, similar to Caesarea above.

Tell Dor

The site is a coastal Tell atop a raised bedrock surface surrounded by abrasion platforms, currently a National Park (Fig.

⁸ N. ANGART, E. GALILI, "The National Nature...".

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7)⁹. Habitation began in the Middle Bronze Age and continued unto the Byzantine period. Until the foundation of Caesarea, it was the main anchorage (type C3) on this stretch of coast, attested to in Egyptian and Biblical sources. There are also remains of a Crusader stronghold.

Marine survey map of Dor (No 6) sheet 22 - Dor anchorages

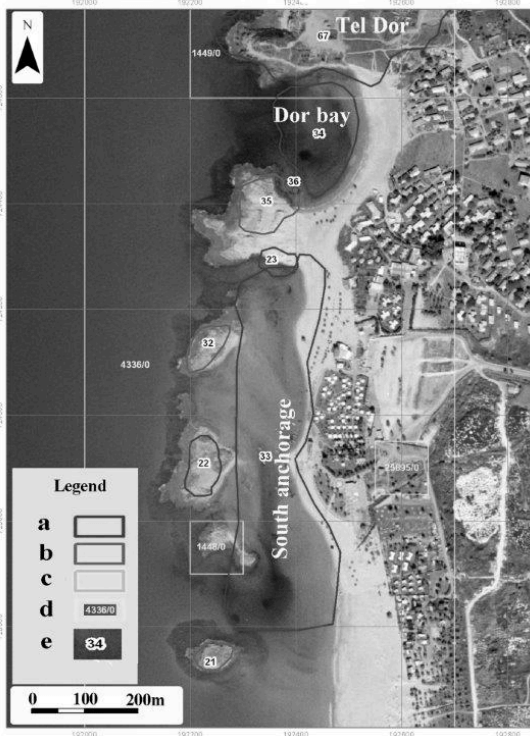


Fig. 7 - Survey map of Dor - depicting the south anchorage (Dor lagoon), Dor Bay and Tell Dor: a, b, c – colored polygons marking the main archaeological features (not including shipwrecks), the colors designate the degrees of importance: a = very important, b = important, c = significant; d = yellow rectangular polygons (numbered) designating sites protected by the law of antiquities; e = identity number of the archaeological features within the survey map.

⁹ N. ANGART, E. GALILI, “The National Nature...”.

Monumental ruins on the southern and western sea fronts are subject to destruction by marine erosion. Several shipwrecks containing wooden hulls, cargoes and a wealth of finds were excavated in the southern lagoon (Fig. 8) and in the bays south and north of the ancient tell. Underwater surveys were carried out, risk assessment survey and protection plans were prepared. The endangered sea front requires protective measures and conservation works. Underwater rescue excavations and surveys should continue.



Fig. 8 - The Ottoman shipwreck DW2 in Dor lagoon

Tell Tanninim – (Krokodilopolis)

The site is a coastal Tell atop a Kurkar Cliff c. 10 m. high, surrounded by abrasion platforms, on the southern bank of Nahal Tanninim. The settlement flourished mainly in the Roman-Byzantine periods. The kurkar bedrock is being eroded in the western part of the site. In the northern part there is a section of the settlement which is subject to marine erosion. North of the Tell there are impressive remains of an Ottoman stone bridge,

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worthy of rehabilitation and conservation. Underwater surveys revealed small anchorages (type C3) north west and southwest from the Tell. Risk assessment survey and protection plans were prepared. Protection and conservation measures should be implemented as well as salvage excavations and underwater rescue surveys.

Arsuf (Apollonia)

The site is an ancient coastal city surrounded by a wall and is functioning as a National Park¹⁰. The settlement dated to the Roman-Byzantine periods was founded on top a high coastal Kurkar cliff, reaching 35 m in its present form. A fortress, fortified by walls, towers and a moat, was built by the Crusaders (Fig. 9). Since the Mamluk conquest it lay in ruins. At the fortress' seafront there are structural remains, perhaps part of the fortifications or a small harbor for boats. South of the site there is a natural anchorage (type C2) used since the Middle Bronze Age, where several shipwreck assemblages were recovered.



Fig. 9 - Arsuf, the endangered Crusader fortress.

¹⁰ N. ANGART, E. GALILI, "The National Nature..."; E. GALILI, "Ancient harbors..."; E. GALILI, A. RABAN, J. SHARVIT, "Forty years...".

Principal risks: There is a significant narrowing of the coastal sand strip following major construction works (marina) south of the site. The waves are eroding the foot of the coastal cliff, creating notches and causing severe safety problems. The eroding cliff is collapsing, causing the disintegration of large sections of the monumental archaeological remains. Consequently there is a massive destruction of the seafront within the perimeter of the Crusader moat. Valuable archaeological and cultural assets and data are being lost.

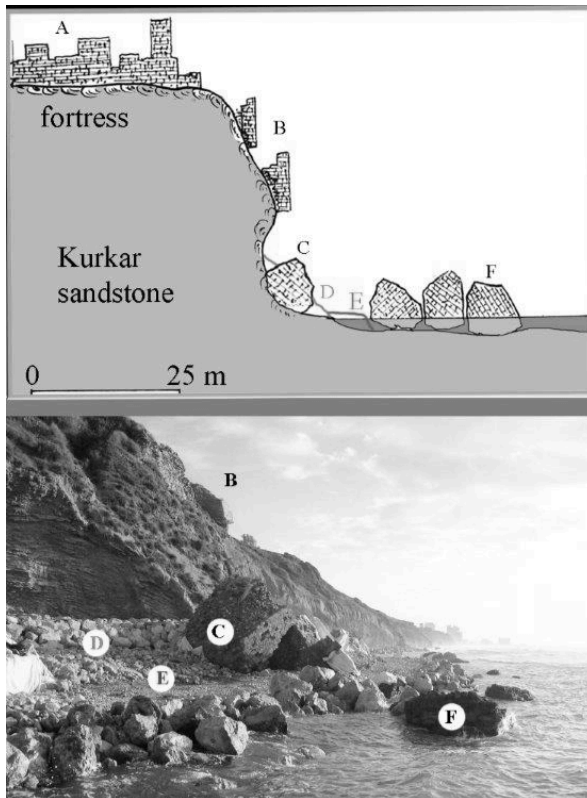


Fig. 10 - Arsuf A) Crusader fortress, B) sea walls in danger of collapse, C) collapsed sections of the sea walls at the cliff's foot; D) Modern protection of the cliff foot by a sea wall made of boulders; E) Modern temporary road used for the construction of the protection, F) Collapsed blocks of the ancient walls in the shallow sea.

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Measures implemented: Risk assessment survey and underwater surveys were carried out. A detailed plan for the conservation and protection of the site's seafront was prepared. A sea wall made of boulders was built in 2009, aimed at protecting the coastal cliff base from marine erosion (Fig. 10).

Measures required: Conservation and archaeological measures are required according to the detailed plan, as in Caesarea above.

Yavne-Yam

The site is an ancient coastal city functioning as a National Park¹¹. The coastal cliff in its present condition is about 10-12 m. high. Yavne-Yam (Fig 1) was occupied since the Early Bronze Age and flourished during the Persian and Hellenistic periods. In the Early Islamic period, a fortified citadel was erected on the small cape. West of the settlement there are remains of a natural anchorage (type C2), the principal one in southern Israel, where numerous shipwreck assemblages were recovered.

Principal risks: The same as in Caesarea above.

Measures implemented: Archaeological excavations were conducted on the site's upper part. A limited number of salvage excavations were conducted near the beach, where a well and other installations were exposed. An underwater survey and a risk assessment survey of the site's seafront were performed.

Measures Required: Reconstruction, conservation and further archaeological measures are required as in Caesarea above.

Ashdod-Yam

The site is a fortified compound founded in the early Moslem period. The fortress remains are surrounded by a wall

¹¹ N. ANGART, E. GALILI, "The National Nature..."; E. GALILI, "Ancient harbors..."; E. GALILI, A. RABAN, J. SHARVIT, "Forty years...".

that has been excavated. A part of the sea front was restored. The fortress' sea front, as well as the walls and structures built on the coast south of it, are being damaged by marine erosion. Protective conservation and restoration measures were carried out and ongoing monitoring and maintaining measures are required.



Fig. 11 - Ancient water well destroyed on the sea front of Ashkelon North site.

Ashkelon North (Askelon Mayumas)

The site is located on the coastal cliff, c. 15-20 meters high. It includes settlement remains from the Byzantine period and a fortified compound, both severely destroyed by the sea. It is mentioned in historical sources as a maritime suburb of Ashkelon. Remains of large structures including a city wall, wells (Fig. 11) and installations were exposed at the seafront. The site has yet to be studied and so far only a limited salvage excavation

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has been conducted along its fringes. Numerous shipwreck assemblages and cargoes were exposed on the seabed opposite the site. There was apparently no harbor there and the ships anchored off-shore (anchorage type C5), where their cargo was unloaded by lighters, similar to the situation in Tell Ashkelon (below).

Principal Risks: Similar to Tell Ashkelon below. The construction of the marina and the detached breakwaters south of the site caused a severe shortage of sand on the seabed and on the beach, and the destruction of the cliff bottom by waves was accelerated. The collapse rate and beach erosion is as much as 1 m yearly (Fig. 12). Consequently, the cliff is collapsing and ancient remains are being destroyed.



Fig. 12 - A sewer outlet in Ashkelon North, demonstrating the cliff retreat of more than 1 m yearly. The two upper lines depicts the location of the coastal cliff in 1999 and the lower line indicates the present cliff edge.

Measures Implemented: Underwater and risk assessment surveys were conducted and protection plans were prepared. Additionally, the bottom of the cliff was temporarily protected by installing sand filled "geo technic" sleeves which lasted only a few years (Fig. 13).

Measures Required: Reconstruction and safety problems are similar to those listed for Caesarea (above) and Tell Ashkelon (below).

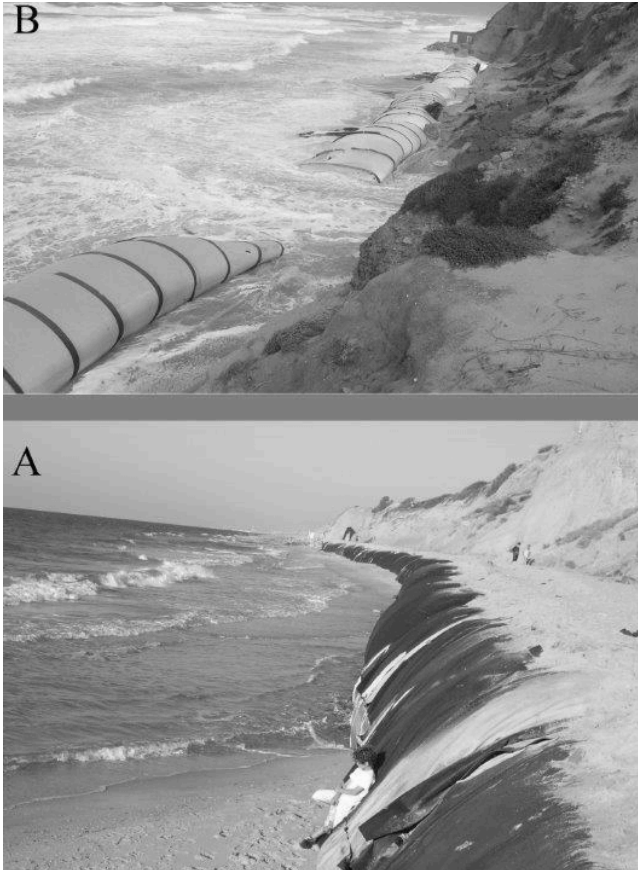


Fig. 13 - Geo technic sand sleeve protection in Ashkelon North: a) after construction; b, c) a protective layer is being built, d) sea storms damaged the protective layer two years later.

Archaeological measures: Extensive excavations should be carried out on the cliff in order to save the archaeological information. Additionally, the measures listed for Caesarea above should be implemented.

Tell Ashkelon

Tell Ashkelon is an ancient fortified coastal city and a National Park¹². The site is heavily eroded by the sea creating a coastal cliff of c. 30 m. high. The earliest remains are ascribed to the Chalcolithic period; the city existed almost uninterruptedly until the Ottoman period. In the Bronze Age the city was encompassed by a wall made of mud bricks and was later refortified throughout the ages. No remains of built were recovered, however, several wooden piles stuck in the sea bottom in a row of parallel to the coast were found some 150 m offshore. These may be the remains of a detached mole. Concentrations of lost anchors adjacent to a submerged rock some 200 m from the coast suggest that and the ships anchored off-shore (anchorage type C5), where their cargo was unloaded by lighters. Numerous Roman architectural elements, made of granite and marble, were recycled and reused for the fortifications in later periods.

Principal Risks: (as in Caesarea above)

Measures Implemented: A pilot project of protecting an ancient seawall section (the "colonnaded wall") was completed (Fig. 14). Underwater surveys were carried out to locate, document and salvage shipwrecks and cargo remains exposed on the seabed. A conservation risk assessment survey and a detailed protection plan were prepared for the sea front of the site, similar to Caesarea above.

¹² N. ANGART, E. GALILI, "The National Nature..."; E. GALILI, "Ancient harbors..."; E. GALILI, A. RABAN, J. SHARVIT, "Forty years...".

Measures required - reconstruction measures: All quality sections of the seafront should be protected by boulders adjacent to the foot of the slope and/or by multiyear depositing of sand. The drainage of the slope and the area above it should be controlled. The slopes should be stabilized by means of terraces, vegetation and nets.



Fig. 14 - Ashkelon sea wall under reconstruction works: a) before works, b, C) a protective layer is being built on the wall face, D) the protective layer underwent erosion by the storm waves.

Conservation measures: Maintaining and repairing the protection of the sea wall, including filling in voids, pointing up joints and stabilizing the slope. Implementing a complete conservation plan of the buildings and the installations on the sea front of the site is required. Follow-up and yearly monitoring is to be done, including panoramic photographs and locating new risks.

Archaeological measures: Extensive salvage excavations of the buildings and installations at the Tell seafront, which are in immediate danger of destruction.

Submerged Neolithic Settlements at risk

Submerged prehistoric villages discovered in situ off the Israeli coast are among the best preserved in the world. They provide important information about the material culture of the coastal Neolithic population. These sites, previously protected by sand for millennia, are now being exposed because of sand shortage due to human intervention in the coastal environment. Immediately after their exposure the sites are destroyed by currents and waves. Several Neolithic settlements dating from the 10th to the 7th millennium BP have been exposed on the seabed along the Carmel coast. The sites (Fig. 15) include a Pre-Pottery Neolithic C (PPNC) settlement called Atlit-Yam (type A1), and five Pottery-Neolithic (PN) settlements belonging to the Wadi Rabah culture¹³ (of types A1 and A2). The archaeological evidence obtained from the submerged sites enabled the reconstruction of palaeoenvironments and Holocene sea levels in the Carmel Coast. They also provide valuable information concerning the material cultures, economy and subsistence of coastal settlements in the southern Levant during the Neolithic period.

Pre pottery Neolithic- Atlit-Yam site: The site of Atlit-Yam is situated some 200-400 m offshore, at a depth of 8-12 m and extends over an area of ca. 40,000 m². Radiocarbon dates for the site gave a range of 9180-8550 years BP (calibrated). The architectural finds consist of water-wells built of undressed

¹³ E. GALILI, M. WEINSTEIN-EVRON, I. HERSHKOVITZ, A. GOPHER, M. KISLEV, O. LERNAU, L. KOLSKA-HROWITZ, H. LERNAU, "Atlit-Yam: A Prehistoric Site on the Sea Floor off the Israeli Coast", *Journal of Field Archaeology* 20, 1993, 133-156; E. GALILI, B. ROSEN, "Submerged Neolithic settlements off the Mediterranean coast of Israel", J. BENJAMIN, C. BONASAL, C. PIKARD, A. FISHER (eds.), *Submerged Prehistory*, Oxford 2011, 272-286.

stones, thus far the earliest known of their kind (Fig. 16), foundations of rectangular dwellings, series of long unconnected walls, round storage and production installations, ritual megaliths (Fig. 17) and stone-paved surfaces.

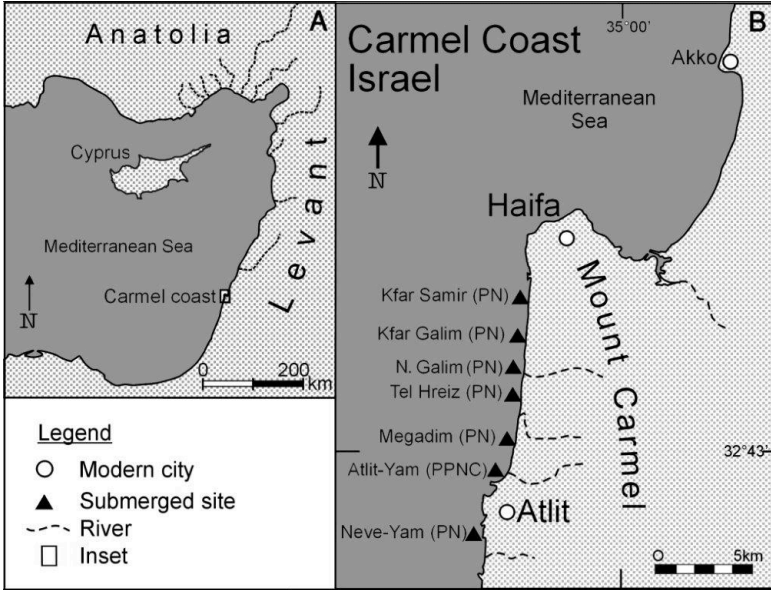


Fig. 15 - Submerged Neolithic settlements off the Carmel coast.



Fig. 16 - Atlit-Yam pre Pottery Neolithic water well.

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In addition, 65 human skeletons were discovered in both primary and secondary burials. Faunal remains consisted of bones of wild and domesticated animals, including domesticated sheep/goat, pig, dog, as well as cattle on the verge of domestication. Fish remains included more than 6000 bones, most of them belonging to *Balistes carolinensis*, (the grey trigger fish). Artifacts made of stone, bone, wood and flint were also recovered, as well as large quantities of botanical remains, including seeds of domesticated wheat, barley, lentil and flax. Some of the artifacts and plant remains may be associated with fishing by poisoning. The archaeological material indicates that the economy of the site was complex and based on the combined utilization of terrestrial and marine resources, involving plant cultivation, livestock husbandry, hunting, gathering and fishing. Underwater rescue surveys and excavations should be conducted when buildings, installations and burials are exposed on the seabed. Sections of the site are randomly exposed by winter storms and need to be mapped, studied, conserved and protected.

Pottery Neolithic sites: The five PN sites, Kfar-Samir, Kfar-Galim, Tel-Hreiz, Megadim and Neve-Yam (Fig. 15), are submerged at depths of 0.5-5 m and were dated to 8100-7300 yrs. BP (calibrated). The finds from these sites include water wells constructed of alternating layers of tree branches and undressed stones, paved surfaces and wall foundations. Some pits dug in the clay contain thousands of crushed olive-pits and waste resulting from the extraction of olive oil (pulp), thus far the earliest known. Bones of domestic animals and fish were also found, as well as artifacts and ornaments made of stone, bone, wood, and flint. The ceramic assemblage included a variety of vessels for cooking and storage. At Neve-Yam, a cemetery comprising stone-built cist graves, organized in a pattern and separated from the dwelling area was discovered. This is one of the earliest known organized cemeteries in which the graves were situated apart from the dwelling area. The economy of the PN settlements was based

mainly on terrestrial resources, cultivation and herding. Underwater rescue surveys, excavations and conservation actions are needed, similar to the PPNC site mentioned above.



Fig. 17 - A megalithic structure in Atlit – Yam.

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Management of the underwater and coastal heritage

The situation described above necessitated the establishment of a mechanism to ensure proper treatment and preservation of the marine national heritage. This mechanism developed gradually since the foundation of the State of Israel through the following milestones.

Institutions associated with marine archaeology

Pioneers of the sixties: The Underwater Exploration Society of Israel: The society was established in 1961 by E. Linder, A. Raban, J. Galili and S. Shapira. It was the first organization to deal with underwater archaeology in Israel. The society members, who were volunteer divers, carried out operations from the main center at Caesarea and the Maritime Museum in Haifa. The society was engaged in excavations at: Caesarea harbor, Akko harbor, Atlit harbor and Shavey-Zion, as well as excavating shipwrecks in Akko. Underwater surveys were also carried out off the Western- Galilee coasts, the Carmel coast (from Haifa to Caesarea), Apollonia, Ashkelon and the eastern coast of Sinai. Excavations were also carried out off the Red Sea coasts, including the 'Coral Island', 'Sharm El Sheik shipwreck', the 'Mercury shipwreck' and 'Na'amah shipwreck' north of Sharm El Sheikh. The finds from the Sinai coasts were returned to the Egyptian Department of Antiquities after the peace agreement.

The Marine Archaeology Unit of the Israel Antiquities Authority (IAA): The IAA was established in 1989, as a continuation of the former Department of Antiquities. The IAA is a state-controlled body and its primary function is to attend to all antiquity affairs in Israel, including underwater antiquities. The Marine Unit of the IAA is the authorized body in charge of the underwater heritage of Israel and is engaged in state-wide inspection and enforcement of the Antiquities laws, prevention of illegal treasure hunting of marine antiquities, supervision of construction and development projects to prevent damage to

antiquities, conducting rescue excavations and surveys in Israeli seas and inland waters, surveying and excavating areas intended for coastal development.

Marine survey map of Carmel coast (No 7) Sheet 16 - Atlit

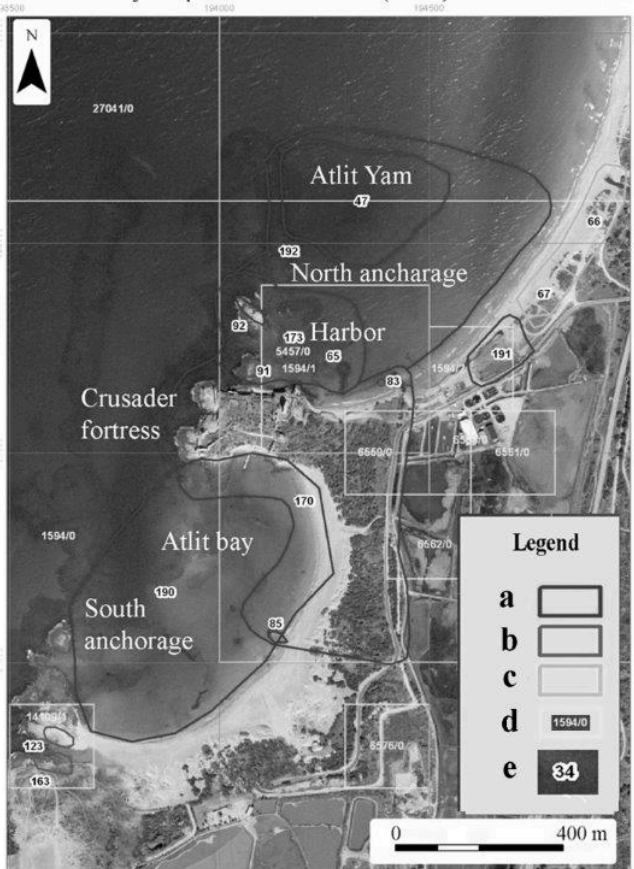


Fig. 18 - Survey map of Atlit depicting Atlit bay, Atlit peninsula and the north bay: a, b, c = colored polygons marking the main archaeological features (not including shipwrecks), the colors designate the degrees of importance: a = very important, b = important, c = significant; d = yellow rectangular polygons (numbered) designating sites protected by the law of antiquities; e = identity number of the archaeological features within the survey map.

“Management of the underwater and coastal archaeological heritage in...”

In addition, the IAA is mapping the underwater archaeological sites to form a national data base (Fig. 18). Based on the available data, underwater and coastal archaeological sites are declared as national protected reserves. The authority is participating in the preparation of state-wide master plans for development, tourism and transportation in Israel's coastal and territorial waters. The material recovered during the surveys, inspection and excavation, is studied and published. Educational activities aimed at raising public awareness include lectures, symposiums, museum exhibitions, educational posters (Fig. 19), the production of postal stamps (Fig 20), documentary films etc.

The Leon Recanati Institute for Maritime Studies, University of Haifa: The institute was inaugurated in 1972. It conducts and promotes research projects that encompass human activities relating to the sea. By combining history, archaeology, earth sciences and marine resources, the institute bridges between the humanities, the sciences and technology. Students participate in the ongoing research carried out at the institute as part of their training, and most of them write theses with the support of the technical staff of the institute. The institute maintains a marine workshop for professional diving and marine surveying. Among the subjects of ongoing research at the institute are: Caesarea land and sea excavations, the Tel Nami land and sea regional project, the Ma'agan Michael shipwreck project, and the Tantura (Dor) lagoon excavations.

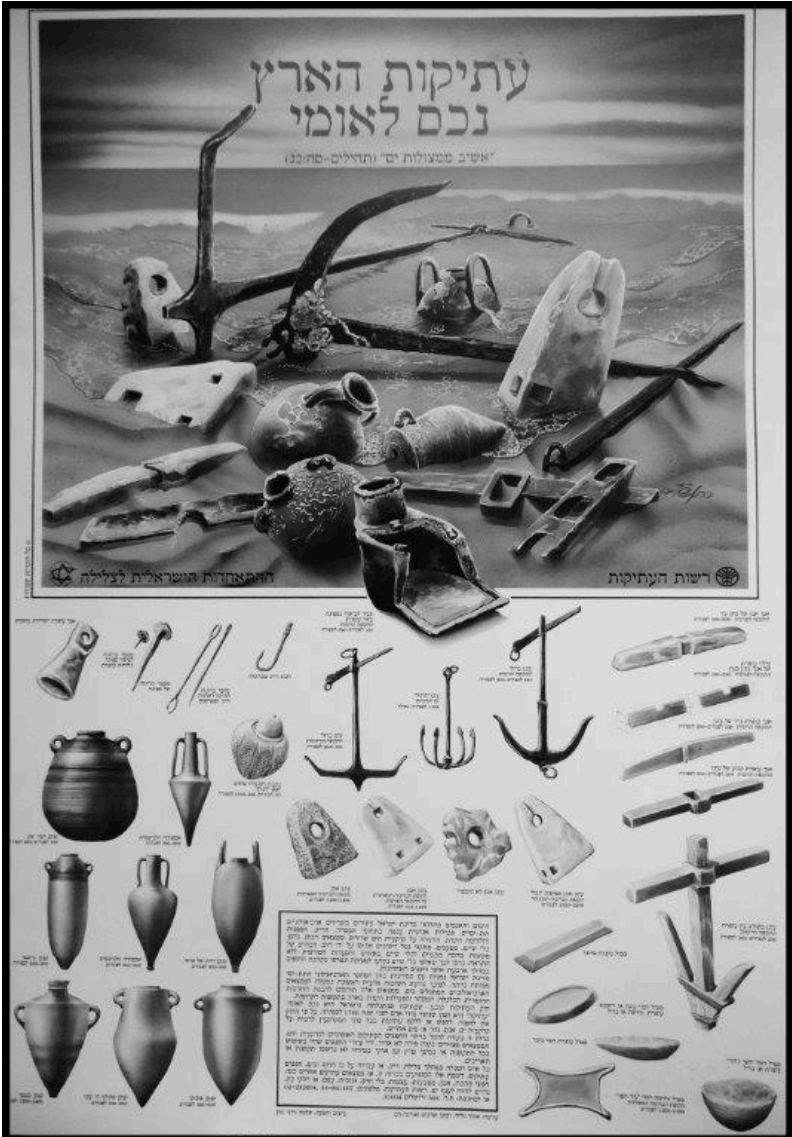


Fig. 19 - Educational poster depicting the typical underwater archaeological finds from Israel.

“Management of the underwater and coastal archaeological heritage in...”



Fig. 20 - A series of stamps depicting the underwater archaeological heritage of Israel.

Legal tools (laws, regulations, policy documents and conventions)

Antiquities law 5738, 1978 (main issues interpretations):

"Antiquity" means any object that was made by man before the year 1700 of the Common Era, or an object made after the year 1700 that was declared as having historical value. "Excavation" or "digging" includes a search for antiquities and a trial digging.

State ownership of Antiquities: Where an antiquity is discovered in Israel, after the coming into force of this law, the antiquity and the area in which it is discovered become the property of the State. A person who discovers an antiquity shall notify the Director of IAA within fifteen days of the discovery.

Excavations: No person shall dig on any land, or otherwise search for antiquities unless he has obtained a license to do so from the Director of IAA.

Antiquity Sites: The Director may declare a particular place as a protected archaeological site. A person shall not carry out or allow to be carried out any of the following on an antiquity site, without the written approval of the Director: building, paving, erection of installations, quarrying, mining, drilling, flooding, clearing away of stones, plowing, planting, or interment; dumping of earth, manure, waste or refuse; erection of buildings or walls on the declared area and the adjoining property.

Antiquities authority law 5749, 1989: Deals with the foundation, organization and management of the Israel Antiquities Authority.

Order regarding wrecked goods and salvage fees, no. 6/ 1926: Determining the directives concerning supervision of goods wrecked at sea and payment for salvaging. ***Policy document for the territorial waters 1999¹⁴:***

Guidelines and necessary steps that should be taken in order to create Integrative Coastal Zone Management (ICZM) that will ensure sustainable use of the resources, as well as maintaining state and public interests. The archaeological section of the document includes a map detailing the most important coastal and underwater archaeological sites, as well as a national database with the specifications of the sites (location, function category, period etc.). The document recommends the maintenance of a comprehensive database of national resources in the coastal zone and territorial waters. Such a database is vital for planners in order to make the right decisions with regard to future development plans and land uses. Another recommendation is to formulate a countrywide master-plan for protecting the ancient coastal sites from marine erosion.

State master plan (no. 13/1985) for the coastal regions: The aims of the plan are to declare the future uses of the land adjacent to the coast, in order to ensure proper management of the natural, cultural and historical resources; guard, develop and use them for bathing, sports, tourism and other essential uses of the coast (ports, marinas etc.). The plan ensures the accessibility of the coast to the public, prevents the erection of buildings at a distance of less than 100m from the coastline, preserves scenery and viewpoints and minimizes conflicts between land uses.

The law for the protection of the coastal environment 2004: The law aims at protecting the coastal environment and the natural and cultural resources in it; striving to restore and

¹⁴ E. GALILI, J. SHARVIT, "Marine Archaeology", *Coastal waters of Israel, Policy document*, Ministry of Internal Affairs, Planning Administration - The national Committee for the coastal waters, Jerusalem 1999 (Hebrew).

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preserve them as a public resource of unique value, to prevent the destruction of such values, to protect the coastal sand for the benefit of the public and to establish sustainable principles for managing, developing and using the coastal environment.

*Government policy document regarding the destruction of the coastal cliffs 2010*¹⁵: The document summarizes the steps to be taken against the collapse of the coastal cliffs along the Israeli Mediterranean Coast - methods of protection, the resulting economic, environmental and public consequences of the collapse, recommendations, responsibilities, priorities and costs of protection.

International conventions signed by Israel

The Hague Convention, concerning the protection of cultural property in the event of armed conflict, 1954; *the Paris Convention*, concerning prohibition and prevention of illicit import, export and transfer of ownership of cultural property, 1970; *the Paris Convention* concerning the protection of international cultural and natural resources, 1972; *UNESCO recommendations* for the protection of cultural resources, 1978; *The Barcelona Convention* for the Protection of the Marine Environment and the Coastal Region of the Mediterranean 1975; *The Geneva Protocol* for the preservation of protected sites in the Mediterranean, 1982.

Establishing a national database of underwater and coastal sites

An essential product of the surveys made by the above-mentioned institutions is a detailed computerized mapping of a data base of the ancient underwater and coastal sites along the Israeli Mediterranean coast. Sites were mapped and categorized

¹⁵ E. GALILI, "Archaeology", *Risk assessment and policy document for the coastal cliffs of Israel*, Attachment to the Government policy document regarding the destruction of the coastal cliffs, The Prime Minister Office, Jerusalem 2010, (Hebrew).

according to archaeological, geographical and cultural parameters, using excel and multi- layer GIS programs. The data accumulated so far during underwater and coastal excavations and surveys were used to build a complete list of coastal and underwater sites (568 sites) arranged in 9 maps (Fig. 21), among them are 227 selected sites of special importance, requiring protection (e.g. Figs. 7,18). The sites were classified according to their archaeological characteristics (shipwrecks, harbors and anchorages, rock cut installations, coastal settlements and submerged settlements) and degree of importance. Site locations were marked by points or polygons and were incorporated into the national master plans (e.g. see the National Nature and Park Authority site:

<http://www.parks.org.il/sigalit/yam/layers/archeological-sites-a.zip>).

A similar data base for inland seas is to be desired.

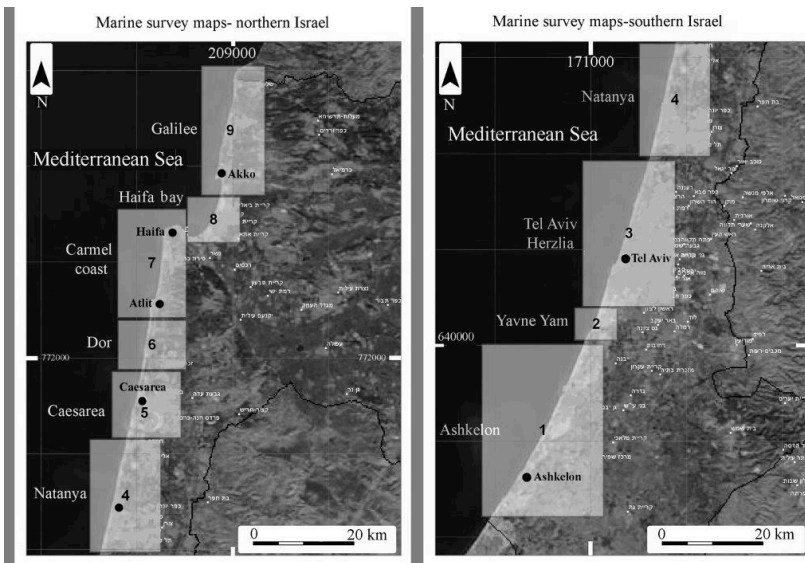


Fig. 21- Key of the nine survey maps that form the data base of the underwater and coastal heritage of Israel.

“Management of the underwater and coastal archaeological heritage in...”

Conducting risk assessment survey and rescue plan of the coastal sites

The risk assessment survey aims: to locate risks to ancient coastal settlements endangered by immediate destruction, to estimate the risk levels and the nature of the threats in different sections of the sites, prioritizing the various treatments, to propose feasible conservation and protection means and to formulate a national plan for saving the coastal and underwater settlements. It also aims to locate sites endangered by immediate destruction (where urgent conservation works are needed), single out sites for salvage excavations and underwater rescue surveys. The survey deals also with later stages, following the initial salvage, including monitoring and yearly maintenance. Additionally it examines the costs of the measures required in the short and long terms, prioritizes the actions and proposes a national budgetary framework for annual and multi-year solutions.

Using the established national data base, the most important coastal and underwater sites were selected for risk assessment surveys. The site surveys were executed by expert conservators, archaeologists and marine engineers. Comprehensive risk assessment documents and detailed conservation plans were prepared for the major sites. The sea fronts of these sites were divided into typical sections which were characterized, analyzed and assessed, based on several chosen criteria (Fig. 6). At the sea front of several other sites partial risk assessment and conservation surveys were conducted. These included photography and documentation of the ancient remains and preliminary estimates of risks, conservation and protection requirements. All the site documents were summarized and a concluding national document was prepared, specifying the risks to the coastal sites, proposing measures to be taken in each site, prioritizing and quantifying the necessary actions and costs (Tables 1, 2).

Protection and Conservation Works: The estimate for the conservation works in the above mentioned document relies on the experience of the Israel Antiquities Authority, accumulated during the course of protection and conservation work implemented in ancient coastal sites. The estimate is an evaluation based on conditions in 2007, information accumulated so far and conservation surveys performed at the different sites. The estimate is comprised of protection and conservation works which have to be done only once, as well as of yearly maintenance works.

Rescue Excavations: The estimate is based on the risk assessment surveys performed in the coastal settlements and the archaeological works needed to salvage the antiquities and the archaeological information at the sea front of the ancient coastal settlements. The scope of the salvage excavations is based on the nature of the sea front, the degree of risk, exposure and likelihood of destruction.

Underwater rescue surveys and inspection: Underwater rescue surveys intended to locate, document and salvage antiquities exposed on the seabed and considered to be at risk of destruction. The objectives of the surveys are to locate, map, document, study and publish endangered underwater artifacts and sites, monitor them and prevent treasure hunting and damage to sites by construction and development works.

Cost assessments of essential actions: The document presents detailed conservation works, protection measures, salvage excavations and underwater surveys required to save the ancient underwater and coastal settlements. In the event of major sea level changes (more than 0.2 m) and additional human intervention along the coast, an up-to-date risk survey will be required.

Conclusions

Lost antiquities cannot be renewed and recreated as modern buildings, infrastructures and, in many cases, natural resources do. Their distraction is permanent and non-reversible.

The coastal and underwater archaeological sites of Israel are considered cultural resources of humanity, and national assets of high cultural, scientific and economic value.

In recent years, much damage has been caused to these sites and extremely valuable archaeological information and monumental ruins have been lost.

On the Mediterranean coast, rising sea levels and the construction of shore installations accelerate coastal erosion and the destruction of the sites.

In the inland seas, the exceptionally low water levels result in the destruction of valuable sites due to erosion, treasure hunting and development activities.

Systematic ongoing surveys are required, aiming at locating, recording, retrieving, studying and protecting the newly exposed sites on the former beds of these inland seas.

Without the implementation of protective and conservation measures, substantial parts of the ancient coastal heritage will be lost within decades.

National and regional master plans for protection and rescue of the ancient coastal and underwater sites should be drafted and implemented.

Rescue excavations should be conducted at the seafront of the ancient coastal cities to salvage the archaeological relics and the valuable information in them.

Underwater rescue surveys should be performed in the vicinity of the ancient coastal sites in order to salvage relics and the archaeological information they bear.

The issue of preserving and protecting the coastal archaeological heritage should become part of the national and international agenda.

A budgetary framework is to be created for the short and long term treatment of the ancient coastal sites.

The protection of the ancient coastal settlements should become a preferred issue in the national order of priorities.

Legal and enforcement tools should assure that during construction and building activities, neither direct nor indirect damage is done to the ancient coastal settlements. Contractors should be required to bear the long term responsibility for damages likely to be caused by building structures and installations near ancient coastal settlements. That should be specifically stipulated in the building permits. These tools should be applied equally to the private and the public sectors, as well as to the army.

Some of the surcharge and taxes for using beach facilities should be allotted to the preservation of coastal antiquities.

Research institutions from Israel and abroad should be encouraged to conduct archaeological rescue excavations in endangered parts of the ancient coastal settlements.

International collaboration should be established with the aim of protecting and conserving the endangered underwater and coastal archaeological heritage of the Mediterranean Coast of Israel and its inland seas.

Raising public awareness, treating the public as an owner of the heritage and encouraging local communities to share the responsibility of monitoring and protecting the sites are key issues in the protection of the underwater and coastal heritage.

SETTLEMENT	TREATMENT PRIORITY LEVEL (1-4)	SITE TYPE	CONSERVATION RISK SURVEY PERFORMED	ONE-TIME MEASURES		ANNUAL MULTI-YEAR ACTIVITY		
				COASTAL RECONSTRUCTION AND PROTECTION (SEAWALL)	CONSERVATION WORKS	MONITORING & MAINTENANCE OF THE PROTECTION	MONITORING & MAINTENANCE-CONSERVATION WORKS	CONSERVATION OF INUNDATED SETTLEMENTS
AKHZIV	3-4	1	Partial	1,000,000	805,000	2% of protection work	4% of conservation work	-
AKKO	1-2 (partly done- 30%)	2	Complete	6,250,000	30,423,000	"	"	-
ATLIT	1-2	2	Partial	3,750,000	10,935,000	"	"	-
ATLIT-YAM	3	3	Partial	-	100,000	-	-	45,000
NEVE-YAM, TELL HREIZE, K FAR GALIM, K FAR SAMIR	3	3	Partial	-	-	-	-	120,000
DOR	2-3	1	Partial	2,000,000	3,407,000	2% of the protection work	4% of the conservation work	-
TELL TANNINIM	3-4	1	Partial	1,000,000	899,000	"	"	-
CAESAREA	1-2	1	Complete	5,000,000	5,694,500	"	"	-
APOLLONIA	1-2 (partly done-30%)	1	Complete	3,750,000	4,880,000	"	"	-
YAVNE-YAM	1-2	1	Complete	2,500,000	3,270,000	"	"	-
ASHDOD-YAM	2 (partly done-30%)	1	Partial	750,000	1,140,000	"	"	-
ASHKELON NORTH	1-2	1	Complete	-	-	"	"	-
TELL ASHKELON	1-2 (partly done-10%)	1	Complete	3,500,000	5,496,000	"	"	-
Total One-time costs				29,500,000	67,319,000			
				5,900,000	13,463,000			
Total Annual Costs						590,000	2,692,000	165,000
						118,000	584,400	33,000

Table 1: Estimated costs of Conservation and Protection Measures (2007 prices in NIS, totals in NIS and Euro)¹

ANCIENT COASTAL SETTLEMENT	TREATMENT PRIORITY LEVEL	KIND OF SITE	COST OF ONE-TIME SALVAGE EXCAVATIONS AND THE NUMBER OF EXCAVATION SQUARES (IN PARENTHESES)	COST OF ANNUAL UNDERWATER SALVAGE SURVEYS AND THE NUMBER OF SURVEY DAYS (IN PARENTHESES)
AKHZIV	3	1	1,890,000 (54)	21,000 (2)
AKKO	3	2	-	21,000 (2)
'ATLIT	3	2	875,000 (25)	92,000 (10)
'ATLIT-YAM PREHISTORIC SITE	1	4	-	105,000 (10)
NEVE-YAM, K FAR SAMIR, K FAR GALIM, TELL HREIZE	1	4	-	276,000 (30)
DOR	3	1	5,600,000 (160)	65,000 (10)
TELL TANNINIM	4	3	1,400,000 (40)	16,000 (2)
CAESAREA	1	1	5,250,000 (150)	85,000 (10)
APOLLONIA	1-2	1	2,800,000 (80)	85,000 (10)
YAVNE-YAM	1-2	1	3,150,000 (90)	85,000 (10)
ASHDOD-YAM	4	1	175,000 (5)	16,000 (2)
ASHKELON NORTH	1	1	3,500,000 (100)	170,000 (20)
TELL ASHKELON	1-2	1	4,200,000 (120)	170,000 (20)
Total One-time Cost of Salvage Excavations			28,840,000 5,768,000	
Total Annual Cost of Underwater Surveys			1,239,300 247,860	

Table 2: Estimated costs of salvage excavations and underwater surveys (2007 prices, totals in NIS and Euro)²

¹ Works that need to be implemented once: Protection, conservation, salvage excavations. Annual works: monitoring, conservation maintenance, maintaining protection installations, salvage excavations and surveys of newly exposed installations. Protection works total 5,900,000 Euro plus 118,000 Euro for annual maintenance. Conservation works total 13,496,000 Euro plus 584,000 Euro for annual maintenance.

² Salvage Excavations total 5,768,000 Euro. They aim at salvaging endangered antiquities and the archeological information at the seafront of the ancient coastal settlements and stabilizing the sea front slope. Underwater rescue surveys total 247,800 Euro. They aim at locating, documenting and salvaging endangered antiquities that are exposed on the seabed.

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